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AUG 13 2003  
TC 1700*

**PROCESS FOR PREPARING THERMOPLASTIC RESIN**  
**HAVING SUPERIOR HEAT-STABILITY**

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This application claims priority of Korea patent Application No. 2000-0037710, filed on July 3, 2000, the content of which is incorporated herein by reference.

**BACKGROUND OF THE INVENTION**

**(a) Field of the Invention**

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The present invention relates to a process for preparing a heat-resistant thermoplastic resin, more particularly to a process for preparing a heat-resistant thermoplastic resin having superior heat-stability prepared by mixing a graft ABS polymer and a heat-resistant copolymer.

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**(b) Description of the Related Art**

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Recently, in order to produce automobile having a lightweight and electric goods requiring [[the]] heat resistance ~~akin to that of such as~~ an electric rice cooker, a microwave oven etc., ~~research has developed a~~ researches on providing heat resistant in acrylonitrile- butadiene-styrene (ABS) resin having superior impact resistance, chemical resistance, and processability etc. have been conducted

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As a [[The]] method for preparing the ABS resin having [[a]] heat ~~resistant~~ resistance, discloses preparation by mixing blending a copolymer having a superior heat ~~resistant~~ resistance with [[the]] a graft ABS polymer has been suggested. The methods for preparing the ABS resin ~~discloses the substitution of a partition or~~ As such a method, substituting a part or total amount of styrene used in the preparation of a heat ~~resistant~~ copolymer for mixing by a methyl styrene having a good heat ~~resistant~~ having heat-resistance to be kneaded with α-methyl styrene having good heat-resistance (U. S. Patent Nos. 3,010,936 and 4,659,790), the method for preparing a heat ~~resistant~~ ABS resin comprising incorporating maleimide compound (Japanese Patent Laid-open publication Nos. sho 58-206657, sho 63-162708, sho 63-235350, and U. S. Patent No. 4,757,109),

~~the method mixing blending polycarbonate resin, and the method charging inorganic material etc. are known.~~

However, the method of using maleimide compound to give heat resistant and the method ~~mixing with~~ of blending polycarbonate resin ~~[[has]] have~~ the problem of reducing processability and ~~[[is]] are~~ not economical due to expensive cost. The method charging inorganic material has a defect in that the impact strength is suddenly reduced. Therefore, the method for preparing ABS resin ~~is widely used method where~~ a-methyl styrene copolymer ~~is prepared by~~ emulsion polymerization, and then the copolymer uses by ~~mixing in case of the preparation of the resin and blending it with graft ABS resin is~~ widely used. Although ~~[[the]] this~~ method is economical and ~~there is can obtain superior~~ impact resistance, ~~a gas occurs in large and glossy property falls during the processing of the resin due to the reaction property having a slow and thermal stability having a lack according to the characteristic of emulsion polymerization of a-methyl styrene compound. reactivity is low and heat stability is low, and thus a lot of gases are generated and gloss property deteriorates during the processing of the resin.~~

### SUMMARY OF THE INVENTION

It is an object of the present invention to provide a method for ~~[[a]]~~ preparing ~~heat-resistant thermoplastic resin having an~~ a thermoplastic resin having excellent heat-resistance, thermal stability, impact resistance, and processability.

In order to achieve the object, the present invention provides a method for preparing a ~~heat-resistant~~ thermoplastic resin composition having ~~[[an]]~~ excellent heat-resistance and heat stability comprising the steps of:

- 25 a) preparing a graft ABS polymer ~~by an~~ through emulsion polymerization ~~by comprising of:~~
  - i) 40 to 70 wt parts of conjugated diene rubber latex;
  - ii) 15 to 40 wt parts of aromatic vinyl compound; and
  - iii) 5 to 20 wt parts of vinyl cyanide
- 30 b) preparing a copolymer having heat-resistance ~~through by a mass~~ polymerization ~~by comprising of:~~

- i) 50 to 80 wt parts of aromatic vinyl compound; and  
ii) 20 to 50 wt parts of vinyl cyanide; and  
c) ~~mixing~~ blending the graft ABS polymer and the copolymer having heat-resistance.

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### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention is described in detail as follows.

The present invention ~~provides prepares~~ a heat-resistant thermoplastic resin 10 having superior heat-resistance, impact resistance and processability, particularly having [[an]] excellent thermal stability, ~~which is that which the by preparing a graft ABS~~ polymer having [[a]] superior thermal stability and impact resistance ~~prepares through by~~ ~~an~~ emulsion polymerization [[by]] ~~with~~ optimizing particle size and gel content of the rubber latex, and [[by]] controlling the graft ratio of the polymer; and ~~that which a heat~~ 15 ~~resistant preparing a copolymer having superior heat-resistance, thermal stability and processability prepares through- with~~ controlling the molecular chain structure by mass polymerization, and then blending the graft ABS polymer [[and]] with the copolymer [[mixes]] having superior heat resistance.

The present invention is described in detail according to the preparation step as 20 follows.

The graft ABS polymer ~~used in mixing material of the present invention is prepared through by conducting a graft copolymerization by emulsion polymerization of the of conjugated diene rubber latex, aromatic vinyl compound and vinyl cyanide compound by emulsion polymerization.~~

25 (Preparation of the graft ABS polymer)

The particle size and gel content of the conjugated diene rubber latex used in the preparation of the graft ABS polymer has a very large influence on the impact strength and processability of resin. Generally, as the particle size of rubber latex becomes small, the impact resistance and processability reduces, and as the particle size becomes large, 30 the impact resistance improves. Also, as the gel content becomes low, polymerization

occurs due to the swelling of monomers on the inside of the rubber latex, and thus as the apparent particle size becomes larger, the impact strength improves.

When preparing the graft ABS polymer, the graft ratio largely affects the property of the polymer. Thus, if the graft ratio is reduced, the un-grafted bare rubber latex exists, 5 and thus thermal stability deteriorates. Also, as the gel content of the rubber latex is large, as the particle diameter is large, and as the graft ratio falls, the improvement of thermal stability is limited.

Therefore, the method for preparing the conjugated diene rubber latex having a suitable particle diameter and gel content is very important, and when the aromatic vinyl 10 compound and vinyl cyanide compound is grafted in the conjugated diene rubber latex, the method for improving graft ratio is very important.

The graft ABS polymer prepares is as follows. The rubber latex having a small diameter is prepared, and the rubber latex having a large diameter is prepared by welding fusing the rubber latex having a small diameter, and then the aromatic vinyl compound 15 and vinyl cyanide compound is mixed in the rubber latex having a large diameter, and the graft ABS polymer is prepared through graft copolymerization by emulsion polymerization of the mixture.

The conjugated diene rubber latex is preferably aliphatic conjugated diene compound, or the mixture of the aliphatic conjugated diene compound and ethylene-based unsaturated monomer. 20

As to the first step, the method for preparing the rubber latex having a small diameter is described as follows.

The rubber latex having a small diameter is conjugated diene polymer, [[the]] which preferably has a particle diameter is preferably from 600 to 1500 Å, the gel of 25 600 to 1500 Å, gel content is preferably from 70 to 95 %, the of 70 to 95 % and swelling index is preferably from of 12 to 30.

The rubber latex having a small diameter is prepared by adding in a lump simultaneously introducing 100 wt parts of conjugated diene monomer, 1 to 4 wt parts of the emulsifier, 0.1 to 0.6 wt parts of the polymerization initiator, 0.1 to 1.0 wt parts of the 30 electrolyte, 0.1 to 0.5 wt parts of the molecular weight controlling agent, 90 to 130 wt

parts of the ion exchange exchanged water in reactor, and [[by]] reacting for 5 to 15 hrs at 55 to 70 °C.

The emulsifier is alkyl aryl sulfonate, alkalimetal alkyl sulfate, sulfonate alkyl ester, soap of fatty acid, alkali salts of rosinate etc., which can be used alone or as-a  
5 mixture of more than in combination of two kinds or more.

The polymerization initiator that can be used is aqueous persulfate or peroxycompound, and oxidation-reduction system compound also can be used. More particularly, the polymerization initiator of aqueous persulfate of sodium or potassium persulfate etc., a fat-soluble polymerization initiator such as cumene  
10 hydroperoxide, diisopropylbenzene ydroperoxide, azobis-isobutyinitrile, tert-butylhydroperoxide, paramethane hydroperoxide, benzoyl peroxide etc. can be used, which also can be used alone or as a mixture of more than in combination of two kinds or more.

The electrolyte can be used alone or as a mixture of more than in combination of two kinds or more. It is preferably selected from the group consisting of KCl, NaCl, KHCO<sub>3</sub>, NaHCO<sub>3</sub>, K<sub>2</sub>CO<sub>3</sub>, Na<sub>2</sub>CO<sub>3</sub>, KHSO<sub>3</sub>, NaHSO<sub>3</sub>, K<sub>4</sub>P<sub>2</sub>O<sub>7</sub>, K<sub>3</sub>PO<sub>4</sub>, Na<sub>3</sub>PO<sub>4</sub>, K<sub>2</sub>HPO<sub>4</sub>, and Na<sub>2</sub>HPO<sub>4</sub> etc.

The molecular weight controlling agent is preferably of mercaptan series.

The polymerization temperature for preparing latex having a small diameter is very important to control the gel content and swelling index of the rubber latex, wherein  
20 the selection of initiator should be considered.

As to the second step, the method for preparing the rubber latex having a large diameter is described as follows.

Rubber latex The preparation of the rubber latex having a large diameter performs a welding process of the rubber latex is prepared by fusing rubber latex having a small diameter. Generally, the particle diameter of the rubber latex having a large diameter provides a high impact property in the thermoplastic resin and is very important a thermoplastic resin, and thus preparation thereof is very important. In order to satisfy the property properties in the present invention, the required particle diameter is  
30 preferably from 2500 to 5000 Å.

The size of the particle is increased by slowly adding introducing 2.5 to 4.5 wt parts of acetic acid for 1 hr into 100 wt parts of the rubber latex having a small diameter prepared as the above described method by the above-described method, that is to say, which has a particle diameter of 600 to 1500 Å, [[the]] gel content [[is]] of 70 to 95%, and [[the]] swelling index s 12 to 30, and then agitation is stopped and the rubber latex having a large increased particle diameter is fused to prepare rubber latex having a large diameter which has particle diameter of 2500 to 5000 Å, gel content of 70 to 95%, and swelling index of 12 to 30. prepared through welding by stopping the agitation so as to have 2500 to 5000 Å of the particle diameter, 70 to 95% of the gel content, and 12 to 30 of the swelling index.

As to the third step, the grafting process is used. That is to say, the method is that the A grafting process will be described. The process is to mix aromatic vinyl compound and vinyl cyanide compound is mixed by adding in the rubber latex having a large diameter, and then the graft ABS polymer is prepared by the conduct graft copolymerization of the mixture through by an emulsion polymerization.

The grafting method is that 15 to 40 wt parts of aromatic vinyl compound, 5 to 20 wt parts of vinyl cyanide, 0.2 to 0.6 wt parts of emulsifier, 0.2 to 0.6 wt parts of the molecular weight controlling agent, 0.1 to 0.5 wt parts of the polymerization initiator etc. [[is]] are added graft copolymerized by adding to 40 to 70 wt parts of the conjugated diene the rubber latex having a large diameter prepared by the above method to conduct a graft copolymerization. Wherein, [[the]] polymerization temperature is preferably 45 to 80 °C, and the polymerization time is preferably 3 to 5 hrs.

During the polymerization of the graft, the method of adding of In the graft polymerization, each component can be used addition method in a lump, multi-step addition method, and continuous addition method, particularly, in order to improve the graft ratio and minimize the formation of solid material, the multi-step adding method and the continuously adding method is preferable. simultaneously introduced, dividedly introduced in multi-stages, or continuously introduced. In order to improve graft ratio and minimize the formation of solid material, the multi-stage introduction or continuous introduction is preferable.

The aromatic vinyl compound is preferably selected from the group consisting styrene,  $\alpha$ -methyl styrene, o-ethyl styrene, p-ethyl styrene, and vinyl toluene

The vinyl cyanide compound is preferably selected from the group consisting of acrylonitrile, methacrylonitrile, and ethacrylonitrile.

5 The emulsifier used in polymerization reaction is alkyl aryl sulfonate, alkali methyl alkyl sulfate, sulfonated alkyl ester, soap of fatty acid, alkali salt of rosinate etc., it may be used alone or as a mixture of more than two kinds.

The molecular weight controlling agent is preferably tertiary dodecylmercaptan.

10 The polymerization initiator can use As the polymerization initiator, an oxidation-reduction catalyst system prepared by a mixture of peroxide such as cumenhydroperoxide, diisopropylbenzenehydroperoxide, persulfate etc., and reductant such as sodium formaldehyde sulfoxylate, sodium ethylenediamine tetra-acetate, ferrous sulfate, dextrose, sodium pyrrolinate, sodium sulfite etc.

15 After polymerization is complete, the polymerization conversion ratio of the obtained latex is over 96%. An antioxidant and a stabile agent is stabilizer are added to the latex, and a powder is obtained by solidifying the latex is solidified with the aqueous solution of sulfuric acid at temperature of over 80 °C, and then dehydrating and drying dehydrate and dried to obtain powders.

20 The stability of the graft copolymer latex is considered evaluated by measuring the solid type solidification part solidified content (%) as described in Equation 1 below.

[Equation 1]

Solid type solidification part Solidified content (%) = (weight of formed solid material in reactor (g)/weight of total rubber and monomer) x 100

25 When the solid type solidification part solidified content is over 0.7%, the stability of the latex is deteriorates. in addition, obtaining a suitable graft polymer in the present invention is difficult due to the many amounts of solid material. deteriorates, and a graft polymer suitable for the present invention cannot be obtained due to a plenty of solid material.

In addition, the graft ratio of the graft polymer is measured as follows.

30 The graft polymer latex is obtained in a powder form by solidifying, washing, and drying. And then, 2g of the powder is stirred for 24 hrs with the addition of 300 ml of acetone.

The solution separates by using ultra-centrifuge, and the un-grafted part is obtained by dropping separated acetone solution to methanol, and dried and the weight of the un-grafted part is measured by drying. The graft ratio is measured according to Equation 2 below using the measurement value.

5 [Equation 2]

Graft ratio (%) = (weight of grafted monomer/weight of rubber property) x 100

Wherein, if the graft ration ratio is below 25 %, thermal stability deteriorates and thus the graft polymer is not suitable for the present invention is not suitable due to a reduction of thermal stability.

10 (Preparation of a copolymer having heat-resistant eopolymer)

The heat-resistant A copolymer having heat-resistance is prepared [[by]] with controlling a suitable ratio of aromatic vinyl compound and vinyl cyanide compound by using mass polymerization.

15 The aromatic vinyl compound is preferably selected from the group consisting of styrene  $\alpha$ -methyl styrene, o -ethyl styrene, p -ethyl styrene, and vinyl toluene, and a - methyl styrene is more preferable.

The vinyl cyanide compound is preferably selected from the group consisting of acrylonitrile, methacrylonitrile, and ethacrylonitrile, acrylonitrile monomer is more preferable.

20 As an example of the preparation, 50 to 80 wt parts of  $\alpha$ -methylstyrene monomer, 20 to 50 wt parts of acrylonitrile, 26 to 30 wt parts of toluene as a solvent, 0.1 to 0.5 wt parts of di-tert-dodecylmercaptan as [[the]] a molecular weight controlling agent are introduced into a reactor, and the mixture is polymerized while maintaining introduced amount is mixed by adding in a reactor, wherein an amount of adding of the components controls so as to so that average reaction time becomes 2 to 4 hrs of average reaction time of the mixture solution, and the mixture solution polymerizes under condition maintaining at and maintaining reaction temperature to 140 to 170 °C. This preparation process is performed [[in]] by a continuous process consisting of pump adding raw material, in a reactor consisting of a pump for adding raw material, a continuous agitation bath, a pre-heating bath, and an evaporation bath, a pump for transferring polymer and an extruder, carrying pump and extrusion processing instrument.

The distribution of the molecular chain structure of the obtained copolymer of α-methylstyrene (AMS) and acrylonitrile (AN) copolymer is analyzed [[by]] using  $^{13}\text{C}$  NMR analyzer. The analysis method is that the obtained pellet is dissolved in deuterium chloroform, and NMR peaks the resultant is measured [[by]] using 5 tetramethylsilane as the inner standard material. In the measured peak of measured 140~150 ppm, the peak of those appearing in the range of 141 to 144 ppm are regarded as a chain structure of alphamethylstyrene-acrylonitrile- acrylonitrile (AMS-AN-AN), shows in 141~144 ppm of the scope, the peak the chain structure of alphamethyl styrene alphamethylstyrene acrylonitrile (AMS AMS AN) shows in 10 144.5~147 ppm of the scope, the peak the chain structure of alphamethylstyrene- alphamethylstyrene alphamethylstyrene (AMS AMS AMS) shows in 147.5~150 ppm of the scope, and then the obtained copolymer is analyzed by measuring the area of the peaks and those appearing in the range of 147.5 to 150 ppm are regarded as a chain structure of alphamethyl styrene-alphamethylstyrene-acrylonitirle (AMS-AMS-AN).  
15 And, the area of these peaks are measured and analyzed.

If the chain structure of alphamethylstyrene-alphamethylstyrene- alphamethylstyrene (AMS-AMS-AMS) among the molecular chain structure of the heat-resistant copolymer per is 15% or more of total 100% of the total amount is over 15% chain structures, thermal stability reduces due to the pyrolysis of the chain structure of 20 alphamethylstyrene-alphamethylstyrene-alphamethylstyrene (AMS-AMS-AMS) when processing. If the chain structure of alphamethylstyrene- alphamethylstyrene- alphamethylstyrene (AMS AMS AMS) alphamethylstyrene-acrylonitrile-acrylonitrile (AMS-AN-AN) is over 40% 45%, [[the]] heat-resistant property is [[poor]] inferior. Thus, the molecular structure of the heat-resistant copolymer having heat-resistance 25 preferably comprises less than 15% of the chain structures of alphamethylstyrene- alphamethylstyrene-alphamethylstyrene (AMS-AMS- AMS), and comprises less than 40% 45% or less of the chain structures of alphamethylstyrene-acrylonitrile-acrylonitrile (AMS-AN-AN).

(Mixing Blending process)

30 The heat-resistant thermoplastic [[rein]] resin having [[an]] excellent thermal stability heat resistance and thermal stability is prepared by adding introducing [[the]]

additives [[of]] such as a lubricant, an antioxidant, and a light stabilizer etc. into the graft ABS polymer prepared by an emulsion polymerization and the heat-resistant copolymer prepared by mass polymerization, and then by mixing having heat resistance prepared by a mass polymerization, and then blending.

5 The mixing ratio of the graft ABS polymer and heat-resistant the copolymer having heat resistance is preferably 20 : 80 ~ 80 : 20.

The resin is prepared in pellet form [[by]] using a double screw extrusion mixer at 230 to 250 °C, and then the property of the pellet is measured by injecting the pellet injected to measure the properties thereof.

10 The property properties [[is]] are measured by [[the]] ASTM method, wherein the thermal stability of heat-resistant the thermoplastic resin investigates the color of the specimen before retention and the color deviation of specimen after retention where the pellet prepared by the mixing process is injected through retention for 15 min. at 250 °C by using the injection instrument. having heat resistance is examined by color deviation of the specimen before and after retention of the pellet at 250 °C for 15 minutes using an extruder. As the color deviation is minimal less, the thermal stability of the thermoplastic resin is superior.

15 Hereinafter, the present invention is described in more detail through the following EXAMPLES and COMPARATIVE EXAMPLES. However, the following EXAMPLES are only for the understanding of the present invention, and the present invention is not limited to the following EXAMPLES.

## EXAMPLES

### EXAMPLE1

25 a) Preparation of [[the]] a graft ABS polymer  
(Preparation of [[the]] rubber latex having a small diameter)  
100 wt parts of ion exchanged water, 100 wt parts of 1,3-butadiene as a monomer, 1.2 wt parts of potassium rosinate as an emulsifier, 1.5 wt parts of potassium oleate, 0.1 wt parts of Na<sub>2</sub>CO<sub>3</sub> as an electrolyte, 0.5 wt parts of KHCO<sub>3</sub>, and 0.3 wt parts of tert-  
30 dodecyl mercaptan (TDDM) as a molecular weight controlling agent was placed together in a lump and placed were simultaneously introduced into a nitrogen-substituted

polymerization reactor (autoclave). The reaction temperature was ~~raised~~ elevated to 55 °C, and then [[the]] reaction was ~~initialized~~ initiated by ~~adding in a lump~~ simultaneously introducing 0.3 wt parts of potassium sulfite as an initiator in the reactor, and ~~reacted~~ the reaction mixture was reacted for 10 hrs. Thereafter, 0.3 wt parts of tert-  
5 dodecyl mercaptan (TDDM) was further added to the reactant, and then the reaction was completed by ~~reacting~~ continued for 8 hrs at 65 °C and completed to obtain [[the]] rubber latex. The obtained rubber latex was analyzed.

10 The analysis of the rubber latex was determined by the ~~gel content, the swelling index, and the particle diameter~~ gel content, the swelling index, and the particle diameter of the rubber latex were measured and analyzed.

The gel content and swelling index was determined as follows.

15 The rubber latex was solidified with ~~dilution~~ diluted acid or metal salt, and the solidification was washed and dried in a vacuum oven for 24 hrs at 60 °C. The obtained rubber mass was cut into small pieces with scissors, and 1 g of the rubber slice was added to 100g of toluene, and then was stored in a dark room at room temperature for 48 hrs. The resultant was separated to sol and gel, and then the gel content and swelling index of each ~~was~~ were measured according to Equations 3 and 4 below.

[Equation 3]

Gel content (%) = (weight of insoluble part (gel)/weight of sample) X 100

20 [Equation 4]

Swelling index = weight of swelled gel/weight of the gel

The particle diameter was measured by the dynamic laser-light scattering method using Nicomp (Model : 370HPL).

25 Wherein, the particle diameter of the obtained rubber latex was 1000 Å, the gel content was 90 %, and swelling index was 18.

(Preparation of [[the]] rubber latex having a large diameter - ~~welding process~~ fusion of the rubber latex having a small diameter)

30 100 wt parts of the prepared rubber latex having a small diameter was added in the reactor, the stirring speed was controlled to 10 rpm, and the temperature was controlled to 30 °C, and then 3.0 wt parts of solution 7 wt% aqueous solution 7 wt% of acetic acid was slowly added in the reactor for 1hr. Thereafter, the agitation was stopped,

and the conjugated diene latex having a large diameter was prepared through welding of by fusing the rubber latex having a small diameter by leaving the resultant for 30 min.

The rubber latex having a large diameter was analyzed by the same method measuring the rubber latex having a small diameter.

5 The particle diameter of the rubber latex having a large diameter was 3100 Å, the gel content was 90 %, and the swelling index was 17.

(Grafting process)

50 wt parts of the rubber latex having a large diameter prepared by the welding fusion process, 65 wt parts of ion exchanged water, 0.35 wt parts of potassium rosinate as

10 an emulsifier, 0.1 wt parts of sodium ethylene diamine tetraacetate, 0.005 wt parts of ferrous sulfate, and 0.23 wt parts of formaldehyde sodium sulfoxylatet was placed together in a lump and placed were simultaneously introduced into a nitrogen-substituted polymerization reactor, and the temperature was raised to 70 °C. The mixture mixed emulsion solution of 50 wt parts of ion exchanged water, 0.65 wt parts of potassium rosinate, 35 wt parts of styrene, 15 wt parts of acrylonitrile, 0.4 wt parts of tert-dodecylmercaptan, and 0.4 wt parts of diisopropylenehydroperoxide was continuously added introduced into the reactant for 3 hrs, and the temperature was raised to 80 °C, and then the reaction was completed by aging for 1 hr the reactor for 3 hrs, and the temperature was raised to 80° C, and then the reaction was completed after aging for 1 hr.

15 Wherein, the polymerization conversion ratio was 97.5 %, the solidified type solidification part content was 0.2 %, and the graft ratio was 37 %. This latex was solidified with aqueous solution of sulfuric acid and by washing washed, and the powder was to obtained obtain powder.

b) Preparation of heat resistant copolymer having heat resistance

20 The raw material mixing of 30 wt parts of toluene 30 wt parts of toluene as a solvent [[and]] 0.15 wt parts of di-tert-dodecylmercaptan as [[the]] a molecular weight controlling agent in 70 wt parts of α-methyl styrene, and 30 wt parts of acrylonitrile was maintained at 148 °C of the reaction temperature by continuously adding were continuously introduced in [[the]] a reactor so as to become 3 hrs of the average reaction time while maintaining reaction temperature of 148° C so that average reaction time becomes 3 hrs. The discharged polymerization solution in the reactor was heated in a

preheater, the un-reacted monomer was volatilized in evaporation reactor, and then the temperature of the polymer was maintained at 210 °C. Thereafter, the copolymer resin was processed in a pellet form [[by]] using a transfer pump ~~extrusion molding and an extruder.~~

5       The obtained molecular chain structure of the obtained heat-resistant copolymer was analyzed with the molecular chain structure with using  $^{13}\text{C}$  NMR analyzer. As a result, the chain structure of AMS-AMS-AMS was 3%, the chain structure of AMS-AN-AN was 20%.

c) Mixing Blending process

10      0.5 wt parts of lubricant and 0.3 wt parts of antioxidant, and 0.1 wt parts of light stabilizer [[was]] were added and mixed in the mixture of 40 wt parts of ABS polymer prepared by the emulsion polymerization and 60 wt parts of the heat-resistant copolymer prepared by mass polymerization. And, then the pellet was prepared [[by]] using a double screw extruder at 240 °C, and the property pellet was measured by injecting the 15 pellet injected again and the properties were measured, and the result was shown in Table 1.

Example 2

a) Preparation of graft ABS polymer

20      The graft ABS polymer was prepared by the same method as Example 1, except that the content of the components was changed in a grafting process, [[as]] 60 wt parts of the rubber latex having a large diameter, 28 wt parts of styrene, and 12 wt parts of acrylonitrile acrylonitrile were used. The graft ratio was 30%, and the content of the solid type solidification part solidified content was 0.3%.

b) Preparation of copolymer having heat-resistant copolymer

25      The heat resistant copolymer having heat resistance was prepared by the same method as Example 1.

The molecular structure of the obtained heat-resistant copolymer was analyzed with the molecular chain structure with using  $^{13}\text{C}$  NMR analyzer. As a result, the chain structure of AMS-AMS-AMS was 4%, the chain structure of AMS-AN-AN was 22%.

30      c) Mixing Blending process

The ~~heat-resistant~~ thermoplastic resin having heat resistance was prepared by the same ~~mixing~~ process as Example 1, except that the graft ABS polymer and heat-resistant copolymer [[was]] were used in the ratio (the additive was the same) as shown in Table 1 below.

5 The property properties of the prepared heat-resistant thermoplastic resin [[is]] are shown in Table 1 below.

Example 3

a) Preparation of graft ABS polymer

The graft ABS polymer was prepared by the same method as Example 1, except that ~~the content of the components was changed~~ in grafting process, [[as]] 45 wt parts of the rubber latex having a large diameter, 38 wt parts of styrene, and 17 wt parts of ~~acrylonitrile~~ acrylonitrile. The graft ratio was 45%, and the content of the solid type solidification part was 0.1%.

b) Preparation of ~~heat-resistant~~ copolymer having heat-resistance

15 The heat-resistant copolymer was prepared by the same method as in Example 1. The ~~obtained heat-resistant copolymer was analyzed with the molecular chain structure with~~ molecular structure of the obtained heat-resistant copolymer was analyzed using  $^{13}\text{C}$  NMR analyzer. As a result, the chain structure of AMS-AMS-AMS was 5%, the chain structure of AMS-AN-AN was 19%.

c) Mixing Blending process

The thermoplastic resin was prepared by the same ~~mixing~~ process as Example 1, except that the graft ABS polymer and heat-resistant copolymer [[was]] were used in the ratio (the additive was the same) as shown in Table 1 below.

25 The property properties of the prepared heat-resistant thermoplastic resin [[is]] are shown in Table 1 below.

Example 4

a) Preparation of graft ABS polymer

The rubber latex having a small diameter (95% of gel content) was prepared by the same method as Example 1, except that 99 wt parts of 1,3- butadiene, and 1 wt parts 30 of styrene were used instead of 100 wt parts of 1,3-butadiene as monomer was changed,

and the rubber latex having a large diameter was prepared, and then the graft ABS polymer was prepared through the grafting process.

b) Preparation of heat-resistant copolymer

The heat-resistant copolymer was prepared by the same method as in Example 1.

5 The molecular structure of the obtained heat-resistant copolymer was analyzed ~~with the molecular chain structure with using~~<sup>13</sup>C NMR analyzer. As a result, the chain structure of AMS-AMS-AMS was 3%, the chain structure of AMS-AN-AN was 21%.

c) Mixing Blending process

10 The ~~heat resistant thermoplastic resin having heat resistant~~ was prepared by the same ~~mixing~~-process as Example 1, except that the graft ABS polymer and heat-resistant copolymer ~~[[was]]~~ were used in the ratio (the additive was the same) as shown in Table 1 below.

The property properties of the prepared heat-resistant thermoplastic resin ~~[[is]]~~ are shown in Table 1 below.

15 Comparative example 1

a) Preparation of the graft ABS polymer

The rubber latex having a small diameter was prepared by the same method as Example 1, ~~and then~~, except that in preparation of the rubber latex having a large diameter, the content of acetic acid for ~~welding fusing~~ the rubber latex having a small 20 diameter was changed to 20 wt parts. The particle diameter of the rubber latex having a large diameter was 2200 Å.

The graft ABS polymer was prepared through grafting process by the same method as in Example 1, except the ~~rubber latex having a large diameter~~ above.

b) Preparation of heat-resistant copolymer having heat-resistance

25 The heat-resistant copolymer was prepared by the same method as in Example 1.

The molecular structure of the obtained heat-resistant copolymer was analyzed ~~with the molecular chain structure with using~~<sup>13</sup>C NMR analyzer. As a result, the chain structure of AMS-AMS-AMS was 4%, the chain structure of AMS-AN-AN was 20%.

c) Mixing Blending process

The heat-resistant thermoplastic resin was prepared by the same mixing process as Example 1, except that the graft ABS polymer and heat-resistant copolymer was used in the ratio (the additive was the same) as shown in Table 1 below.

5 The property properties of the prepared heat-resistant thermoplastic resin [[is]] are shown in Table 1 below.

#### Comparative example 2

##### a) Preparation of [[the]] a graft ABS polymer

The rubber latex having a small diameter (65% of the gel content) was prepared by the same method as Example 1, except that [[each]] polymerization temperature was lowered by 3 °C in the process of preparing rubber latex having a small diameter. The rubber latex having a large diameter was prepared, and the graft ABS polymer was prepared through the grafting process by the same method as Example 1.

##### b) Preparation of heat-resistant copolymer having heat-resistance

The heat-resistant copolymer was prepared by the same method as in Example 1.

15 The molecular structure of the obtained heat-resistant copolymer was analyzed ~~with the molecular chain structure with using~~ <sup>13</sup>C NMR analyzer. As a result, the chain structure of AMS-AMS-AMS was 5%, the chain structure of AMS-AN-AN was 22%.

##### c) Mixing Blending process

The heat-resistant thermoplastic resin was prepared by the same mixing process as Example 1, except that the graft ABS polymer and heat-resistant copolymer [[was]] were used in the ratio (the additive was the same) as shown in Table 1 below.

20 The property properties of the prepared heat-resistant thermoplastic resin [[is]] are shown in Table 1 below.

#### Comparative example 3

##### a) Preparation of graft ABS polymer

The graft ABS polymer was prepared through a grafting process by the same method as Example 1, except that 71 wt parts of the rubber latex having a large latex and 20 wt parts of styrene, and 9 wt parts of acrylonitrile ~~was changed~~ were used in the grafting process. The grafting ratio was 20%, the solidified content of the solid type solidification was 0.4%.

##### b) Preparation of heat-resistant copolymer having heat-resistance

The heat-resistant copolymer was prepared by the same method as Example 1.

The molecular structure of the obtained heat-resistant copolymer was analyzed with the molecular chain structure with using  $^{13}\text{C}$  NMR analyzer. As a result, the chain structure of AMS-AMS-AMS was 5%, the chain structure of AMS-AN-AN was 23%.

5           c) Mixing Blending process

The heat-resistant thermoplastic resin was prepared by the same mixing process as Example 1, except that the graft ABS polymer and heat-resistant copolymer [[was]] were used in the ratio (the additive was the same) as shown in Table 1 below.

10          The property properties of the prepared heat-resistant thermoplastic resin [[is]] are shown in Table 1 below.

Comparative example 4

a) Preparation of the graft ABS polymer

The graft ABS polymer was prepared by the same method as in Example 1.

b) Preparation of copolymer having heat-resistant eopolymer

15          [[The]] A heat-resistant copolymer was prepared by the same method as in Example 1, except that 55 wt parts of  $\alpha$ -methyl styrene and 45 wt parts of acrylonitrile, instead of 70 wt parts of  $\alpha$ -methyl styrene and 30 wt parts of acrylonitrile, was used.

20          The molecular structure of the obtained heat-resistant copolymer was analyzed with the molecular chain structure with using  $^{13}\text{C}$  NMR analyzer. As a result, the chain structure of AMS-AMS-AMS was 1 %, the chain structure of AMS-AN-AN was 45%.

c) Mixing Blending process

The heat-resistant thermoplastic resin was prepared by the same mixing process as the Example 1, except that the graft ABS polymer and heat-resistant copolymer [[was]] were used in the ratio (the additive was the same) as shown in Table 1 below.

25          The property properties of the prepared heat-resistant thermoplastic resin [[is]] are shown in Table 1 below.

Comparative example 5

a) Preparation of the graft ABS polymer

[[The]] A graft ABS polymer was prepared by the same method as in Example 1.

b) Preparation of copolymer having heat-resistant eopolymer

[[The]] A heat-resistant copolymer was prepared by the same method as in Example 1, except that 85 wt parts of a-methyl styrene and 15 wt parts of acrylonitrile, instead of 70 wt parts of a-methyl styrene and 30 wt parts of acrylonitrile [[was]] were used.

5 The molecular structure of the obtained heat-resistant copolymer was analyzed ~~with the molecular chain structure with using~~ <sup>13</sup>C analyzer. As a result, the chain structure of AMS-AMS-AMS was 19%, the chain structure of AMS-AN-AN was 8%.

c) Mixing Blending process

10 The heat-resistant thermoplastic resin was prepared by the same mixing process as Example 1, except that the graft ABS polymer and heat-resistant copolymer [[was]] were used in the ratio (the additive was the same) as shown in Table 1 below.

The property properties of the prepared heat-resistant thermoplastic resin [[is]] are shown in Table 1 below.

Comparative example 6

15 a) Preparation of the graft ABS polymer

[[The]] A graft ABS polymer was prepared by the same method as in Example 1.

b) Preparation of copolymer having heat-resistant eopolymer

20 [[The]] A heat resistant copolymer [[was]] prepared by ~~the heat resistant eopolymer emulsion polymerization~~ (PW600A, products of LG. CHEMICAL CO. LTD) ~~prepared by emulsion polymerization was used~~, instead of the heat resistant copolymer prepared by mass polymerization.

25 The molecular structure of the heat-resistant copolymer prepared by emulsion polymerization was analyzed ~~with the molecular chain structure with using~~ <sup>13</sup>C NMR analyzer, the chain structure of AMS-AMS-AMS was 8%, the chain structure of AMS-AN-AN was 30%.

c) Mixing Blending process

The heat-resistant thermoplastic resin was prepared by the same mixing process as Example 1, except that the graft ABS polymer and heat-resistant copolymer [[was]] were used in the ratio (the additive was the same) as shown in Table 1 below.

30 The property properties of the prepared heat-resistant thermoplastic resin [[is]] are shown in Table 1 below.

Table 1

The heat-resistant thermoplastic resin composition having heat resistance prepared by the method according to the present invention has an especially excellent thermal stability, as well as having an excellent heat-resistance, impact resistance, and processability.

	Example				Comparative Example					
	1	2	3	4	1	2	3	4	5	6
Graft ABS polymer (Wt parts)	40	38	39	40	40	38	39	40	38	39
Copolymer having heat resistance (Wt parts)	60	62	61	60	60	62	61	60	62	61
Notch izod impact strength (ASTM D-256)	45	41	42	46	18	36	37	48	35	26
Flow index (ASTM D-1238)	6	7	7	6	6	7	6	6	7	4
Heat deflection temperature (°C) (ASTM D-648)	105	106	105	104	106	106	106	100	108	106
Thermal stability (ΔE)	good	good	good	good	good	ordinary	ordinary	good	bad	ordinary
	2.7	3.4	3.1	2.9	2.9	3.8	3.9	1.8	7.2	3.9